

OTHER RED ROCKFISH

by

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Relative to last years' final BSAI SAFE Report, the following changes have been made in the assessment of the Other Red Rockfish.

- 1) Information on other red rockfish is presented as a separate SAFE chapter
- 2) The 1999 landings have been revised and the 2000 landings through September 30, 2000 have been included in the assessment.
- 3) The 2000 Aleutian Island survey biomass estimates have been included in the assessment.
- 4) To prevent overfishing on northern rockfish in the eastern Bering Sea, a single ABC and OFL for the northern/sharpchin group in the entire BSAI area is considered. This rationale, and the proposed harvest levels, are discussed in the Appendix.

A summary of the recommended 2001 ABC levels relative to the 2000 recommendations is as follows:

	Eastern Bering Sea		Aleutian Islands	
	2000	2001	2000	2001
Northern/Sharpchin	--	--	5,153 t	6745 t
Rougheye/Shortraker	--	--	885 t	912 t
Other red rockfish	194 t	135 t	--	--

A summary of the recommended 2001 OFL levels relative to the 2000 recommendations is as follows:

	Eastern Bering Sea		Aleutian Islands	
	2000	2001	2000	2001
Northern/Sharpchin	--	--	6,870 t	8,994 t
Rougheye/Shortraker	--	--	1,180 t	1,215 t
Other red rockfish	259 t	179 t	--	--

INTRODUCTION

Pacific ocean perch, and four other associated species of rockfish (northern rockfish, *S. polyspinis*; rougheye rockfish, *S. aleutianus*; shortraker rockfish, *S. borealis*; and sharpchin rockfish, *S. zacentrus*) were managed as a complex in the two distinct areas from 1979 to 1990. Known as the POP complex, these five species were managed as a single entity with a single TAC (total allowable catch). In 1991, the North Pacific Fishery Management Council enacted new regulations that changed the species composition of the POP complex. For the eastern Bering Sea slope region, the POP complex was divided into two subgroups: 1) Pacific ocean perch, and 2) shortraker, rougheye, sharpchin, and northern rockfishes combined, also known as “other red rockfish” (ORR). For the Aleutian Islands region, the POP complex was divided into three subgroups: 1) Pacific ocean perch, 2) shortraker/rougheye rockfishes, and 3) sharpchin/northern rockfishes. These subgroups were established to protect Pacific ocean perch, shortraker rockfish, and rougheye rockfish (the three most valuable commercial species in the assemblage) from possible overfishing. The northern/sharpchin group, while less valuable than other members of the POP complex, represent a significant portion of the aggregate biomass. Each subgroup is now assigned an individual TAC.

The assessment methodology has differed for Pacific Ocean perch and other red rockfish. Pacific ocean perch has historically been the most abundant rockfish in this region and has contributed most to the commercial rockfish catch. Furthermore, the bulk of the research on rockfish has been concentrated on *S. alutus*; relatively little biological or assessment information is available for the other rockfish species. Thus, the Pacific ocean perch are assessed with an age-structured population model, whereas the other red rockfish are assessed with survey biomass estimates. In previous SAFE reports, information on other red rockfish was presented in the Pacific ocean perch chapter.

CATCH HISTORY

Relatively little is known about fisheries for other red rockfish in the BSAI region. Catches of other red rockfish from the eastern Bering Sea and Aleutian Islands since 1993 are shown in Table 1. Shortraker/rougheye and sharpchin/northern removals from the Aleutian Islands region for the same time period are also provided in this table. In recent years, the catches of the ORR group is dominated by northern rockfish in the Aleutian Islands, and by northern rockfish and shortraker rockfish in the eastern Bering Sea (see Appendix). Much of the catch of northern rockfish in the Aleutian Islands is bycatch in the Atka mackerel fishery and is discarded (David Clausen, NMFS-Auke Bay Laboratory, pers. comm.), accounting for the high discard rates seen in Table 2.

ASSESSMENT METHODS

Absolute Abundance

Biomass estimates for other red rockfish were produced from cooperative U.S.-Japan trawl survey from 1979-1985 on the eastern Bering Sea slope, and from 1980-1986 in the Aleutian Islands. U.S domestic trawl surveys were conducted in 1988 and 1991 on the eastern Bering Sea slope, and in 1991,1994, 1997, and 2000 in the Aleutian Islands (Table 3). An experimental eastern Bering Sea slope survey was also conducted in 2000, the results are not yet available. The biomass estimate for the eastern Bering Sea has two surveyed components—the eastern Bering Sea slope component and the Aleutian Islands component of the eastern Bering Sea management region.

The biomass estimates from the 1991,1994, and 1997 Aleutian Island surveys were re-estimated in 2000 with more accurate estimates of survey strata. A comparison with the data used in the 1999 assessment (Table 3) reveals that occasionally a large change in the biomass estimates occurred, such as the 1991

estimate of shortraker rockfish changing from 6,615 t to 1,925 t. However, most of the changes in biomass estimates were small. The 2000 biomass estimates for shortraker and northern rockfish in the eastern Bering Sea of 538 t and 40 t, respectively, were considerably below their 1997 estimates.

In most cases, the variances about these point estimates were large, making it almost impossible to determine significant changes in biomass from one survey year to the next. The interannual variation in point estimates was substantial, and more than one would expect from the life history and exploitation patterns of other red rockfish. For example, the biomass estimates for northern rockfish in the Aleutian Islands decreased 57% from 214,673 t in 1991 to 92,433 t in 1994, and increased 135% from 87,186 t in 1997 to 205,300 t in 2000. Thus, we thought it prudent to take an average of the survey point estimates to arrive at a recent biomass for each species in each region. In addition, we excluded the data from the cooperative U.S.-Japan trawl surveys (1979-86) from the averages, as these surveys were conducted with considerably different vessels and gear than the U.S. domestic trawl surveys (1988-1997) (Skip Zenger, National Marine Fisheries Service, Seattle, WA, personal communication). Using this approach we estimate the current biomass of northern, rougheye, and shortraker rockfish as follows (sharpchin rockfish biomass is insignificant in both regions):

	Eastern Bering Sea	Aleutian Islands
Northern rockfish	422 t	149,898 t
Rougheye rockfish	1,713 t	12,260 t
Shortraker rockfish	3,722 t	30,301 t
Sharpchin rockfish	*****	*****
	Not common in either area	

REFERENCE FISHING MORTALITY RATES AND YIELDS

Other red rockfish are classified in tier 5 of Amendment 56, and reference fishing mortality rates are based upon estimates of natural mortality. The F_{abc} is defined as 75% of M , and estimates of M for rougheye, shortraker, and northern rockfish are from Heifetz and Clausen (1991). The acceptable biological catch is obtained by multiplying F_{abc} by the estimated biomass. This procedure results in the following ABCs:

	M	EBS	Aleutian Islands
Northern rockfish	0.060	19 t	6,745 t
Rougheye rockfish	0.025	32 t	230 t
Shortraker rockfish	0.030	84 t	682 t
Sharpchin rockfish	*****	Not common in either area	

The overfishing mortality level for the other rockfish species was calculated as $F_{OFL} = M$, and are summarized by region below:

	EBS	Aleutian Islands
Northern rockfish	25 t	8,994 t
Rougheye rockfish	43 t	306 t
Shortraker rockfish	112 t	909 t
Sharpchin rockfish	*****	*****
	Not common in either area	

Currently, the eastern Bering Sea harvest is regulated by a single quota for the above four species combined. One potential problem with this is that members of the complex may be overfished without reaching the group harvest quota. For example, the population size of northern rockfish in the eastern Bering Sea appears to be much less than the other populations, raising a conservation concern. In addition, preliminary data suggest that the rougheye and shortraker rockfish occupy a distinctly different depth range than the other species in the complex and can be targeted on readily. Furthermore, there is an economic incentive to target on rougheye and shortraker rockfish because they command a much higher ex-vessel price than the other species in the complex. These concerns are addressed further in the Appendix, where an alternative to the single group ABC for the eastern Bering Sea other red rockfish are considered. Under the current management procedures, our recommendations for ABC and OFL levels are as follows:

	Eastern Bering Sea		Aleutian Islands	
	ABC	OFL	ABC	OFL
Northern/Sharpchin	--	--	6,745 t	8,994 t
Rougheye/shortraker	--	--	912 t	1,216 t
Other red rockfish	135 t	180 t	--	--

Table 1. Estimated removals (t) of the “other red rockfish,” sharpchin/northern, and rougheye/shortraker subgroups from the eastern Bering Sea and Aleutian Islands regions.

Year	Eastern Bering Sea	Aleutian Islands	
	Other red rockfish	SCNO	SRRE
1993	487	4,486	1,130
1994	129	4,668	926
1995	344	3,872	558
1996	207	6,653	960
1997	230	1,997	1,042
1998	111	3,675	678
1999	227	5,225	485
2000*	228	4,691	395

*Estimated removals through September 30, 2000.

Table 2. Estimated retained, discarded, and percent discarded of other red rockfish (ORR), sharpchin/northern (SC/NR), and shortraker/rougheye (SR/RE) from the eastern Bering Sea (EBS) and Aleutian Islands (AI) regions.

Species		Catch				
Area	Group	Year	Retained	Discard	Total	Percentage
EBS	ORR	1993	390	97	487	19.9%
		1994	28	101	129	78.3%
		1995	273	71	344	20.6%
		1996	58	149	207	72.0%
		1997	57	173	230	75.2%
		1998	41	71	112	63.4%
		1999	67	161	228	70.6%
		2000*	107	121	228	53.1%
AI	SC/NR	1993	320	4,166	4,486	92.9%
		1994	798	3,870	4,668	82.9%
		1995	1,207	2,665	3,872	68.8%
		1996	2,269	4,384	6,653	65.9%
		1997	145	1,852	1,997	92.7%
		1998	459	3,289	3,748	87.8%
		1999	521	4,735	5,256	90.0%
		2000*	273	4,418	4,691	94.2%
AI	SR/RE	1993	733	397	1,130	35.1%
		1994	700	224	924	24.2%
		1995	455	103	558	18.5%
		1996	752	208	960	21.7%
		1997	732	310	1,042	29.8%
		1998	449	235	684	34.4%
		1999	293	191	484	39.5%
		2000*	244	150	394	38.1%

* Estimated removals through September 30, 2000.

Source: NMFS Alaska Regional Office

Table 3. Estimated biomass (t) of rougheye, shortraker, and northern rockfishes from the NMFS bottom trawl surveys, with comparison with the data used in the 1999 assessment.

Eastern Bering Sea (EBS) Surveys

	Rougheye		Shortraker		Northern	
	1999	2000	1999	2000	1999	2000
1979	1,053	1,053	1,391	1,391	53	53
1981	816	816	3,571	3,571	23	23
1982	605	605	5,176	5,176	24	24
1985	1,716	1,716	4,010	4,010	--	--
1988	876	876	1,260	1,260	4	4
1991	884	884	2,758	2,758	--	--

Aleutian Islands portion of EBS Area I

	Rougheye		Shortraker		Northern	
	1999	2000	1999	2000	1999	2000
1980	922	922	1,020	1,020	341	341
1983	2,830	2,830	13,079	13,079	1,516	1,516
1986	3,511	3,511	6,478	6,478	67,394	67,394
1991	1,274	676	6,615	1,925	763	582
1994	1,186	1,208	1,791	1,959	1,193	855
1997	568	561	2,222	2,428	293	204
2000		888		538		40

Aleutian Islands Surveys

	Rougheye		Shortraker		Northern	
	1999	2000	1999	2000	1999	2000
1980	21,885	21,885	15,963	15,963	43,312	43,312
1983	20,582	20,582	27,913	27,913	43,458	43,458
1986	48,843	48,843	19,345	19,345	133,662	133,662
1991	12,351	10,455	20,191	21,778	181,613	214,673
1994	13,732	13,344	27,286	26,230	81,183	92,433
1997	12,202	11,035	38,661	36,058	80,706	87,186
2000		14,205		37,136		205,300

APPENDIX

The Harvest of Individual Species of Other Red Rockfish in the Bering Sea/Aleutians Islands, with Consideration of New Management Species Groups.

INTRODUCTION

The other red rockfish (northern rockfish, sharpchin rockfish, rougheye rockfish, and shortraker rockfish) in the Bering Sea/Aleutian Islands (BSAI) are managed with harvest quotas applied to two or more members of the group. Further, separate quotas apply to the Bering Sea and Aleutian Island management areas, and the management groups differ between these regions. Thus, a single quota applies to all eastern Bering Sea other red rockfish, whereas separate quotas exist for the northern/sharpchin and rougheye/shortraker management groups in the Aleutian Islands management area.

The efficacy of this management approach has been recently questioned on several grounds. First, there is the concern that individual members of the groups may be overharvested without the group quota exceeded. This concern is particularly relevant for northern rockfish in the eastern Bering Sea management area, where recent survey population estimates are generally smaller than those observed in the Aleutian Islands management area. Second, there is the question of whether the stock structure of the various rockfish species corresponds to the management regions in place. For example, the Aleutian Islands may be considered to have an eastern boundary at Unimak Pass (165° W), but the area from Unimak Pass to westward to 170° W is within the eastern Bering Sea management area. Thus, the management regions bisect the Aleutian Islands, and it is reasonable to question whether rockfish from 165° W to 170° W are a separate stock than those in the remainder of the Aleutians.

The purpose of this appendix is to estimate harvest by species for other red rockfish in each management area, compare harvest levels with overfishing levels, identify the harvest of selected species by fishery, area, and gear. We conclude by considering new management groups of BSAI other red rockfish.

METHODS

The tables in this Appendix were generated from records from the north Pacific observer program database, and the total catch estimates from the Alaska regional office of the National Marine Fisheries Service. The location, gear, and species composition of each haul in the BSAI area that caught rockfish from 1994 to 1999 was obtained from the observer database. A target fishery, defined as the species group with the largest catch, was assigned based on the species composition in the haul. For species groups with more than one species, such as rockfish., the target was further defined as the species within the group with the greatest catch. Note that this definition of targeting is based on the total catch, and does not consider discarding.

The observed catch from the observer database per year, species, and management area were used to compute harvest proportions within the management groups, which in turn were applied to the total catch of the management group. Estimates of catch per species group for 2000 were based on observer records of catch, by species and management region, through October 4, 2000, and NMFS regional office estimates of total catch by management group, through September 30, 2000. The single species ABC and OFL levels were obtained from recent stock assessment documents.

RESULTS

Harvest estimates by species and management region

The catch of other red rockfish in the Aleutian Islands is dominated by northern rockfish, and the estimated harvest in recent years has ranged from 1,997 t to 6637 t (Table A-1). In 1996, the estimated northern rockfish harvest exceeded their single species ABC levels but not the OFL level. The ABC level was also exceeded in 1996; the OFL level was not computed for this year.

The rougheye/shortraker group in the Aleutian Islands were composed primarily of rougheye rockfish, whose proportion of the group has varied from 0.68 to 0.92 in recent years. The estimated harvest of rougheye rockfish has occasionally exceeded their harvest limits, sometimes by large amounts. For example, the estimated catch in 1997 was 958 t, as compared with ABC and OFL levels of 440 t and 587 t, respectively.

The catch of other red rockfish in the eastern Bering Sea has had northern rockfish as the largest component in recent years, followed by shortraker rockfish; these two species ranged from 79% to 94% of the other red rockfish (Table A-2). Often the estimated catches of these two species are similar, but because the population size of northern rockfish in recent assessments is estimated to be considerably smaller than shortraker rockfish (based upon average biomass of the post-1986 NMFS surveys), the northern rockfish have smaller harvest quotas. For example, the estimated 2000 catch of northern rockfish (through September 30) was 103 t, exceeding the ABC and OFL estimates of 34 and 45 t, respectively.

Northern rockfish harvest estimates by management region, fishery, area, and gear

Northern rockfish in the Aleutian Islands are primarily harvested by the Atka mackerel trawl fishery. The harvest of northern rockfish, per year, was obtained for various combinations of fishery, INPFC area, and gear; the ten such combinations with the largest observed catch, per year, are shown in Table A-3. It is interesting to note that the observed northern rockfish harvest in the Atka mackerel fishery was highest in the central Aleutians (area 542) in 1995 and 1996, and in the western Aleutians since 1997. The observed harvest in these combinations of fishery, gear, and area makes up a very large proportion of the total observed harvest, which in turn is a large proportion of the estimated total catch. Thus, the observer data is expected to be representative of the total harvest.

In contrast, the harvest of northern rockfish in the eastern Bering Sea are distributed in a variety of fisheries, primarily the Atka mackerel, walleye pollock, and rockfish fisheries (Table A-4). In 1996 and 1999, the catch in the Atka mackerel fishery was particularly high. In 1995, 144 t of northern rockfish catch were observed in area 531, accounting for nearly all of the catch in the observer database. In other years, a relatively large proportion of the observed harvest occurred in areas 517, 518, and 519, ranging from 41% to 81%; these areas are in the southwestern portion of the eastern Bering Sea management area and include a portion of the Aleutian Islands. The actual location of all observed hauls in the EBS management area that northern rockfish in 1999 is shown in Figure 1, and a closer view of area 519 is shown in Figure 2. A relatively high proportion of all hauls that caught northern rockfish occurred in area 519 (Figure 3).

Again, the observed harvest from the top ten combinations of target fishery, area, and gear were a high proportion of the total observed catch. With the exception of 1997, the observed catch varied from 43% to 61% of the total estimated catch.

DISCUSSION

The concern that some rockfish species are being harvested at levels exceeding single species harvest quotas appears to be justified, particularly for northern rockfish in the eastern Bering Sea where the relatively low biomass estimates in recent surveys have led to low harvest quotas. In developing strategies to prevent northern rockfish harvest from exceeding overfishing limits, it is useful to consider whether the eastern Bering Sea and Aleutian Islands regions should be considered as a single stock.

The biomass of northern rockfish observed in 1988 and 1991 surveys of the eastern Bering Sea slope were small, and also appears to be small in the 2000 survey (Dr. Jay Orr, Alaska Fisheries Science Center, pers. comm.). Thus the northern rockfish in the Bering Sea management area appears to occur primarily in the southwestern portion of this management area, much of which, as mentioned earlier, shares similar properties with the Aleutian Islands.

It is unknown whether northern rockfish from the eastern Bering Sea management area are genetically distinct from those in the Aleutian Islands management area. Preliminary results indicate that northern rockfish separated by large distances in the north Pacific did not show heterogeneity in mtDNA or microsatellite DNA (Dr. Tony Gharrett, University of Alaska, pers. comm.). This does not necessarily imply the lack of population structure, and the sample sizes were small. However, in the absence of further evidence, it seems plausible that northern rockfish in the eastern Bering Sea management area are not genetically distinct from those in the Aleutian Island management area, and combining the two management areas is biologically defensible. Of course, this interpretation could change with further evidence.

There is a large amount of uncertainty in the biomass estimates for other red rockfish, and this uncertainty clearly affects our estimates of ABC and OFL and the resulting perception of the relative intensity of northern rockfish harvest. Indeed, the 2000 catch of eastern Bering Sea northern rockfish in the observer database through October 4 exceeded the 2000 biomass estimate of 40 t for the southern Bering Sea. However, the other red rockfish population estimates in the eastern Bering Sea management area have been consistently below those in the Aleutian Islands management area in recent surveys. Further, the northern rockfish biomass in the eastern Bering Sea management area estimates are lower than those of the shortraker and rougheye rockfish in this area. Thus, while it may be sensible to consider northern rockfish as a single stock, it also seems wise to take precautionary measures to prevent the potential of localized depletion within eastern Bering Sea management area.

One strategy would be to split the other red rockfish group in the eastern Bering into two groups consistent with the Aleutian Islands (northern/sharphchin and shortraker/rougheye), combine the northern/sharphchin group between the Aleutian Islands and eastern Bering Sea management areas, and allocate the combined TAC among area in accordance with their biomass estimates. This would result in an total ABC of northern/sharphchin of 6764 t, to be partitioned with 19 t in the eastern Bering Sea and 6745 t in the Aleutian Islands. Note that this procedure produces the same northern rockfish ABC values as viewing the two management regions as completely separate entities, but the advantage is that the BSAI area is viewed as a single stock with ABC recommendations by area. Splitting out the northern/sharphchin group from the other red rockfish group in the Bering Sea leaves the eastern Bering Sea with the shortraker/rougheye group, whose 2001 ABC under this plan would be 116 t. It is not recommended to combine this group across the two regions because preliminary evidence indicated the potential of stock structure within the north Pacific for these species, and work at Dr. Tony Gharrett's lab on this topic is ongoing.

Separating the EBS northern/sharphchin group from the other red rockfish would thus result in an unusually low ABC for this group, and under current management practices may result in the closure of fisheries that take northern rockfish as bycatch. The establishment of closed areas could be considered to

prevent northern rockfish bycatch, and information of the type in Figures 1-3 could be used for this purpose.

Finally, an argument could be made that the roughey/shorotraker group in the Aleutians Islands could be split because of the apparent occasional overfishing of roughey rockfish in recent years. This situation is complicated by differing species proportions of this group between the observer catch data and the survey biomass estimates. In recent years, the harvest of this group appears to consist primarily of roughey rockfish despite the mean biomass estimates from the recent surveys of 12,260 t for roughey rockfish and 30,301 t for shorotraker rockfish. Recommended 2001 ABC for each species of this group are 230 t for roughey rockfish and 682 t for shorotraker rockfish.

FUTURE RESEARCH

As indicated above, our perceptions of overfishing are currently based upon highly uncertain trawl survey data. One goal for future assessments is to attempt to incorporate the uncertainty in biomass estimates to evaluate the likelihood of exceeding F_{abc} , similar to what is now being done with the other species complex in the Gulf of Alaska. Additionally, the longline survey may provide an additional source of data for the other red rockfish.

Table 1. Catch of other red rockfish in the Aleutian Islands from 1994 to 2000, with reported species ABC and OFL levels where available.

	Species	Observed Catch	Proportion of Sp. Group	Estimated total catch	ABC	OFL
2000	Northern Sharpchin Rougheye Shortraker	3696.80 0.12 121.96 96.48	1.0000 0.0000 0.5583 0.4417	4690.84 0.16 220.54 174.46	5153 239 646	6870 319 861
1999	Northern Sharpchin Rougheye Shortraker	4423.65 0.67 285.04 76.04	0.9998 0.0002 0.7894 0.2106	5254.21 0.79 382.87 102.13	4230 405 560	5639 540 747
1998	Northern Sharpchin Rougheye Shortraker	2896.63 0.30 347.62 90.97	0.9999 0.0001 0.7926 0.2074	3673.61 0.39 523.90 137.10	4230 405 560	5639 540 747
1997	Northern Sharpchin Rougheye Shortraker	1424.39 0.17 723.73 64.23	0.9999 0.0001 0.9185 0.0815	1996.76 0.24 957.99 85.01	4358 440 498	5810 587 664
1996	Northern Sharpchin Rougheye Shortraker	4540.15 11.19 519.52 66.44	0.9975 0.0025 0.8866 0.1134	6636.64 16.36 850.27 108.73	5810 587 664	NR NR NR
1995	Northern Sharpchin Rougheye Shortraker	2376.14 9.28 195.61 91.72	0.9961 0.0039 0.6808 0.3192	3857.93 15.07 380.56 178.44	5670 632 590	NR NR NR
1994	Northern Sharpchin Rougheye Shortraker	3223.12 0.91 465.96 108.18	0.9997 0.0003 0.8116 0.1884	4665.68 1.32 750.71 174.29	5670 632 590	NR NR NR

* Observer data through October 4, 2000; total catch estimate through September 30, 2000

Table 2. Catch of other red rockfish in the eastern Bering Sea from 1994 to 2000, with reported species ABC and OFL levels where available.

	Species	Observed Catch	Proportion of Sp. Group	Estimated total catch	ABC	OFL
2000*	Northern Sharpchin Rougheye Shortraker	61.64 0.11 9.82 60.48	0.4518 0.0008 0.0720 0.4433	103.01 0.18 16.41 101.07	34 35 125	45 47 167
1999	Northern Sharpchin Rougheye Shortraker	86.84 1.83 6.21 41.56	0.6365 0.0134 0.0455 0.3046	144.48 3.04 10.33 69.14	537 51 185	716 68 247
1998	Northern Sharpchin Rougheye Shortraker	28.77 0.05 6.91 23.69	0.4841 0.0009 0.1163 0.3987	46.96 0.09 11.28 38.67	537 51 185	716 68 247
1997	Northern Sharpchin Rougheye Shortraker	24.95 0.12 6.97 16.79	0.5109 0.0025 0.1426 0.3439	117.51 0.58 32.81 79.10	788 56 207	1051 75 276
1996	Northern Sharpchin Rougheye Shortraker	61.27 0.01 12.05 35.98	0.5606 0.0001 0.1103 0.3291	116.04 0.01 22.82 68.13	1051 75 276	NR NR NR
1995	Northern Sharpchin Rougheye Shortraker	159.10 0.00 7.33 24.05	0.8352 0.0000 0.0385 0.1263	286.48 0.00 13.20 43.31	1051 75 276	NR NR NR
1994	Northern Sharpchin Rougheye Shortraker	20.08 0.02 11.63 23.79	0.3617 0.0004 0.2095 0.4285	46.66 0.05 27.02 55.27	1051 75 276	NR NR NR

* Observer data through October 4, 2000; total catch estimate through September 30, 2000

Table 3. Observed catch distribution, per year, of northern rockfish in the Aleutian Islands from the top ten combinations of fishery, area, and gear.

Fishery	Area	Gear	Year					
			1994	1995	1996	1997	1998	1999
Atka Mackerel	541	Bottom Trawl	116.05	181.71	364.12	112.74	259.17	902.03
Atka Mackerel	542	Bottom Trawl	1475.87	786.73	888.92	259.55	497.82	580.58
Atka Mackerel	543	Bottom Trawl	850.80	657.52	1366.77	762.84	1319.54	1841.49
Pacific cod	541	Bottom Trawl	37.67	18.15	87.02	40.01	58.13	68.42
Pacific cod	541	Longline					20.78	
Pacific cod	542	Bottom Trawl	81.00					
Pacific cod	542	Longline				5.58		14.43
Pacific cod	543	Bottom Trawl	43.69	30.48			23.07	
Northern	541	Bottom Trawl	129.23	163.80	475.97	6.35	24.40	76.36
Northern	542	Bottom Trawl	249.37	187.90	450.67	41.58		76.87
Northern	543	Bottom Trawl	115.44	175.50	677.51	116.36	519.19	401.77
Pacific Ocean Perch	541	Bottom Trawl	87.76	108.00	71.35			
Pacific Ocean Perch	542	Bottom Trawl		23.99	42.18	9.93	60.60	90.12
Pacific Ocean Perch	543	Bottom Trawl			63.63	54.27	76.29	342.47
Total (top 10 combinations)			3186.88	2333.80	4488.13	1409.21	2858.97	4394.54
Total Observed Catch			3223.12	2376.14	4540.15	1424.39	2896.63	4423.65
Total Estimated Catch			4665.68	3857.93	6636.64	1996.76	3673.61	5254.21

Table 4. Observed catch distribution, per year, of northern rockfish in the eastern Bering Sea from the top ten combinations of fishery, area, and gear.

Target	Area	Gear	Year					
			1994	1995	1996	1997	1998	1999
Atka Mackerel	517	Bottom Trawl	1.39		2.33			2.14
Atka Mackerel	519	Bottom Trawl			38.09		3.53	44.52
Pacific cod	509	Bottom Trawl			0.99			
Pacific cod	513	Bottom Trawl				0.70		
Pacific cod	517	Bottom Trawl		2.35			1.00	
Pacific cod	517	Longline	1.34	0.79			1.96	1.69
Pacific cod	518	Longline		0.58				
Pacific cod	519	Bottom Trawl			1.15		1.32	1.26
Pacific cod	524	Bottom Trawl	0.69					
Pacific cod	531	Bottom Trawl	2.02	3.23	3.86	2.17		
Pacific cod	531	Longline	0.78					
Light Dusky	531	Longline					1.39	
Northerns	517	Bottom Trawl			2.60		5.32	
Northerns	519	Bottom Trawl					2.58	8.29
Northerns	531	Bottom Trawl		55.43				
Northerns	531	Pelagic Trawl						3.20
POP	517	Bottom Trawl				0.66		
POP	518	Bottom Trawl						11.04
POP	531	Bottom Trawl		88.41	2.17	5.33		
Flathead sole	521	Bottom Trawl	0.90					
Pollock	509	Bottom Trawl		0.69				
Pollock	517	Bottom Trawl	4.23	1.26		1.40	1.81	
Pollock	517	Pelagic Trawl	2.54	4.77	2.63	4.12		2.05
Pollock	518	Bottom Trawl				1.21		2.27
Pollock	519	Bottom Trawl					1.30	1.54
Pollock	519	Pelagic Trawl			1.09	1.49	1.22	
Pollock	531	Bottom Trawl	1.17					
Rock sole	517	Bottom Trawl		0.39				
Arrowtooth	517	Bottom Trawl	0.58		1.81	1.29		
Arrowtooth	531	Bottom Trawl				3.18		
Total (top 10 combinations)			15.63	157.89	56.71	21.55	21.43	78.00
Observed proportion in areas 517, 518, 519			0.50	0.06	0.81	0.41	0.70	0.86
Total Observed Catch			20.08	159.10	61.27	24.95	28.77	86.84
Total Estimated Catch			46.66	286.48	116.04	117.51	46.96	144.48

Figure 1. Location of all EBS observed hauls in 1999 where northern rockfish were caught.

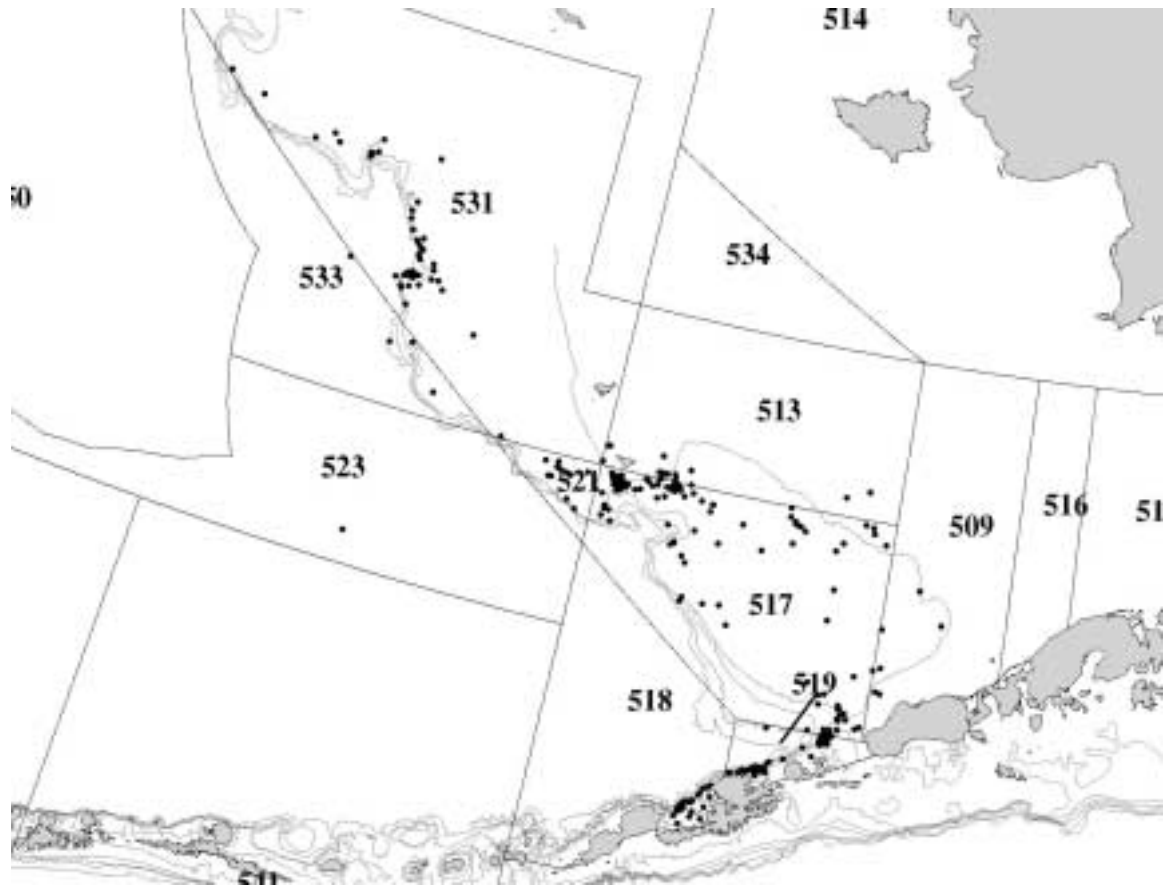


Figure 2. Location of all observed hauls in 1999, area 519, where northern rockfish were caught.

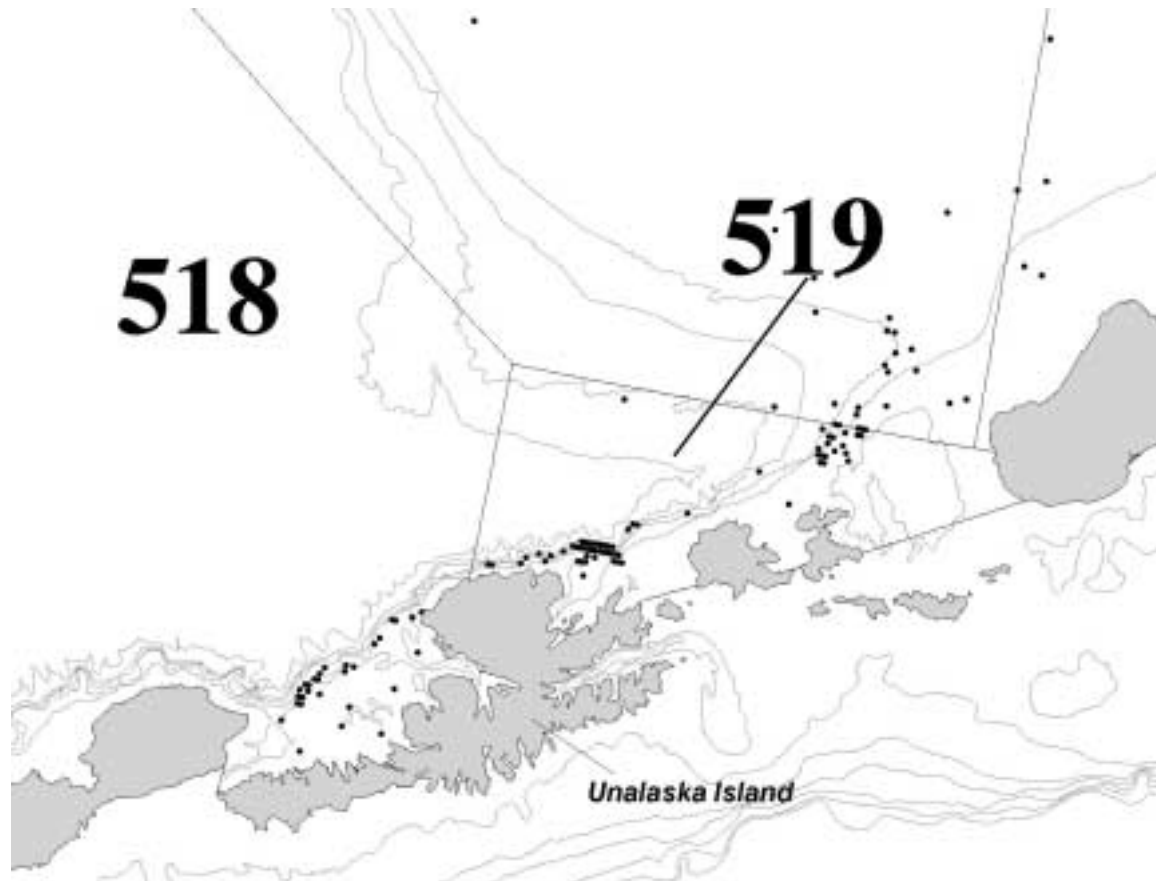


Figure 3. Location of all EBS observed hauls in 1999 where more than 250 kg of northern rockfish were caught.

